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ABSTRACT

The Panel on Educational Research and Development was formed in 1961 to identify research and development programs which might benefit the wide range of educational activities conducted by various Federal agencies. This report summarizes the Panel's proceedings through 1964. Its thesis is that the efficacy of the entire educational establishment can be increased by disseminating the results of worthwhile innovation. To date the Panel's activities have largely concerned elementary and secondary education and the education of teachers. Included are reports on seminars held for eminent educators on such subjects as learning about learning, music education, non-graded schools, and education for the deprived and segregated. The development of a new physics course at MIT is discussed in more detail as an example of curricular innovation. Developing whole experimental school systems is also considered as a possible reform. (RB)

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Innovation and Experiment in Education

A Progress Report of

the Panel on Educational Research and Development

to the U.S. Commissioner of Education,

the Director of the National Science Foundation, and

the Special Assistant to the President for Science

and Technology

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THE PANEL ON EDUCATIONAL RESEARCH AND DEVELOPMENT
IS UNDER THE AUSPICES OF
THE PRESIDENT'S SCIENCE ADVISORY COMMITTEE
EXECUTIVE OFFICE BUILDING
WASHINGTON, D.C. 20506

Preface

The Panel on Educational Research and Development was formed late in 1961 to explore the contribution that research and development can make to education—including instructional materials, classroom practices, teacher education, and school management. The Panel has developed a number of proposals likely to prove of interest to the general public, and so we are releasing for publication the Panel's report to us.

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Washington, D.C.

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DONALD F. HORNIG
Special Assistant to the President for Science and Technology
The White House
Washington, D.C.

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Chairman's Foreword

Great Teachers, a collection of reminiscences edited by Houston Peterson and reprinted by Vintage Books, nicely demonstrates the good fortune of the student who has as his private mentor, or who shares in a classroom with other students, a teacher of exceptional talent. Now, consider the fortunes of all students, not just of a few lucky ones. The task of educational research and development is to learn how to provide for all students the education an exceptional teacher provides for a few.

This report seeks to give some intimation of how educational research and development can help accomplish this task. It seeks, also, to create a climate favorable to educational research and development, for, to be effective, such work must enlist the services of many people already busy doing other things—outstanding scholars or practitioners at the frontiers of their art or science and outstanding teachers. Although the Panel is concerned with all levels of education, it has limited itself so far to elementary and secondary education and to the education of teachers. Necessarily, this report is concerned with only a partial view of the problems facing our educational establishment.

From any point of view, however, the American elementary and secondary school establishment is enormous. Here are some figures for 1963–64, for both public and non-public schools, based on estimates from the U.S. Office of Education and the National Education Association: schools, 125,000; pupils, 47,000,000; teachers, 1,800,000; administrators and supervisors, 100,000; local public school board members, 144,000; total funds spent on elementary and secondary eduation, nearly $25 billion.

But a beginning in educational research and development has been made, and the results are reaching a good proportion of students in certain categories. One early effort was a project in curriculum development in high school physics. Starting in 1956, a group of research physicists and science teachers designed a modern physics course and embodied it in a new textbook, a new set of experiments, new examinations, new teachers' guides, a set of instructional films, and other new instructional materials. The materials were tested in the schools, presented in detail to teachers, and subsequently released for general use. Supported largely by the National Science Foundation, the cost was approximately $1 million a year for 5 years. The American educational establishment is currently spending

around $100 million a year on physics teaching in high schools, be it good or bad. The purpose of this early project was to steer this large expenditure to the support of better instruction.

The Panel on Educational Research and Development is seeking to apply the lessons learned in such efforts to other areas. The aim is to increase the efficiency and efficacy of the entire educational establishment, and so multiply the effectiveness with which all funds are spent. The work of the Panel is described in the report, but I should like to summarize some results that I consider of high priority.

One matter with which the Panel is concerned is the education of those whom it calls the deprived and the segregated. And one possible program in this area is the same kind of large-scale effort in curriculum development that proved effective in improving science instruction. Much mathematics and science instruction, for example, is unnecessarily bookish. It should be possible to design new curricula in these subjects which, although ultimately just as ambitious as more familiar curricula, are less dependent upon the student's reading skill. Indeed, in elementary school, mathematical and scientific problems can themselves become an introduction to reading.

A second possible program in the education of the deprived and the segregated, and one representing a more radical departure from the earlier efforts, is the institution of an experimental school system—or, within a big-city system, a subsystem in a slum area of around 20 to 30 schools. There has been experimentation with nongraded schools, team teaching, on-the-job training for prospective teachers, use of volunteers, and so on. What is lacking is experimentation across the board, with provision for rapid feedback and rapid exploitation of new opportunities. The experimental system would draw not only upon the resources of the schools but also upon universities and other resources normally outside the school system.

Both programs develop out of the circumstance that our modern schools have evolved largely in a middle-class context. The task of bringing the deprived and the segregated into larger society is difficult. And despite some modest efforts and some modest successes, we really know very little about how to accomplish this task. Of course, more classrooms and more teachers are an important part of the answer, but, as the two proposed programs indicate, the Panel does not believe that simply offering more of the same is the full solution.

A second matter with which the Panel is concerned is the preservice and inservice education of teachers. One possible program in this area is the development of more effective instructional materials. These would include special curriculum units for prospective teachers to use in practice-teaching programs; materials that would help a prospective teacher or working teacher examine the problems of teaching a subject, as he advanced in his own study of that subject; and the design and production of films showing all sorts of teachers at work in all sorts of classrooms, with all sorts of children under all sorts of conditions.

This program develops out of a conviction that the grasp of a subject and the "methods" of teaching that subject must be integrated. Special curriculum units in practice-teaching sessions would help get prospective teachers themselves involved in the process of curriculum development. Films would make it really possible, for the first time, to bring the data—the stuff of pedagogy—before prospective teachers in systematic fashion. Films would also prove useful in disseminating new ideas rapidly.

In the preservice education of teachers, such new approaches can fit into the existing curriculum, although closer cooperation than that presently found will be required among public schools, institutions devoted to teacher education, and universities. In the inservice education of teachers, reliance upon research and development is doubly necessary. For, given the objective of bringing all teachers up to date in their subject, the number of teachers is so large as to make the cost prohibitive, if summer programs are contemplated such as those now used in the further education of high school teachers of modern foreign languages, science, and mathematics. Moreover, the manpower necessary to run the requisite number of programs is just not available.

The report offers no estimate of how much money can usefully be spent on educational research and development, but I should like to hazard a figure myself. My estimate is higher than our present expenditures but less than 1 percent of the total cost of education in the United States. The limiting factor is not the dimension of the task but the number of persons available to deal with it.

The Federal Government and private foundations currently spend about $25 million per year on curriculum development at the precollege level. If curriculum development and teacher education are considered together and all the tasks of education are included, a sizable portion of attention being given the special needs of the deprived and the segregated, specific tasks and specific persons can be identified to warrant the expenditure of an additional $90 million per year. To this add $10 million per year to conduct an experimental school subsystem in a slum area, or N times that for N such experiments.

From the view point of educational research and development, one experimental, or model, subsystem is necessary. There is, however, in this notion of an experimental system, with its utilization of universities and other resources outside the school system, a format for a program of special educational projects. Model systems could be established in several cities and in certain rural areas as well.

The additional funds that the Federal Government might spend on educational research and development are to be distinguished from funds it might provide for such forms of general aid as teachers' salaries and school construction. To argue for Federal assistance for educational research and development is not to argue for or against various forms of general aid. The two programs are separate; the one is not offered as a substitute for the other.

There are two omissions in the report, for which the Panel apologizes. Although the report does offer a quick survey of recent work in curriculum reform, no systematic effort is made to relate recent work in educational research and development in the United States to earlier work. A number of competent studies in the history of American education are, of course, generally available. The second omission is the lack of reference to European developments. Again this is a matter which others are studying, and the Panel would only add that any such studies should show the relevancy of the findings to conditions in the United States.

The Panel is under the auspices of the President's Science Advisory Committee, a group of scientists and engineers that constitutes an independent source of technical advice to the President. This committee has become involved in education because of its conviction that experiment can play as great a role in improving American education as it has played in meeting other needs of our society—defense, medicine, agriculture, industrial development. Further, there is an experience gained in research in these other applications that can be utilized in research in education.

The Panel's hope in publishing this report is that it will help advance innovation and experiment in education. What is needed in this field are new projects manned by talented and able persons, with adequate funds and supporting personnel. The report, however, offers no master plan of who should spend what. It only undertakes to suggest some possible starting points for these new projects.

The Panel was established, and this report was essentially completed, during the tenure of Jerome B. Wiesner, now of the Massachusetts Institute of Technology, as Special Assistant to the President for Science and Technology and as Chairman of the President's Science Advisory Committee. We have benefited greatly from his advice and encouragement, and we look forward to working with his successor Donald F. Hornig, as we have been working, and will continue to work, with Francis Keppel and Leland Haworth.

JERROLD R. ZACHARIAS,
Chairman, Panel on Education Research and Development
Member, President's Science Advisory Committee,
Washington, D.C.

I. LEADING IDEAS

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In its broadest outlines, the work of the Panel on Educational Research and Development, established late in 1961, offers no surprises, unless it is a surprise to claim that the job really can be done—the job of making education imaginative and rewarding at all levels, for all subjects, for all students. The Panel, a government advisory unit, was created under the auspices of the President's Science Advisory Committee. It reports to the U.S. Commissioner of Education, the Director of the National Science Foundation, and the President's Special Assistant for Science and Technology, who is also chairman of the President's Science Advisory Committee. Members of the Panel are drawn from the public schools, institutions of higher learning, State and Government agencies, and other institutions associated with education.

All members of the Panel have looked at what *is* going on in the schools and have speculated on what *might* go on in the schools. The Panel's principal interest, however, is the promotion of educational research and development. Increasing the funds that a school spends per child can improve the quality of education with present methods of instruction. But investment in research to create better methods can multiply the effectiveness with which education funds are spent.

The Panel has taken as its domain all of education, inside schools and outside schools, for children and youth and for adults, and it has developed a long list of topics for possible inquiry. But, so far, the Panel has concentrated its efforts on elementary and secondary education and on the education of teachers, and within this area on only a few major topics. The selection of topics shows an effort to move in several directions. Learning about learning is fundamental for long-range improvement; music education explores the possibilities of research and development in a field distant from science; teacher education is central to every effort toward reform; and education for the deprived and the segregated is an important facet of the attack on poverty.

Although the Panel is working in several quite different fields, certain features are common to all its operations.

Research and Development

Research and development in education is not a new idea. People have designed courses before, and have written textbooks and tested the results of new courses and new textbooks. Others have built experimental schools and have tried out new programs of teacher education. But recent efforts do have some new characteristics.

Recent efforts have brought together, over relatively short periods, large concentrations of talent—outstanding scholars and teachers in the fields in question and the necessary supporting personnel. A good example is the first such large-scale effort—the design of a modern physics course and its embodiment in a set of curricular materials by the Physical Science Study Committee, a group of physicists based initially at the Massachusetts Institute of Technology. The materials include a textbook, films, laboratory apparatus, laboratory guides, examinations, teachers' guides, programs for training teachers in the use of these materials, and a series of paperback books on scientific topics and scientists. Large numbers of professional physicists and professional teachers were involved, as well as many people experienced in editing, in making films, and in designing laboratory equipment. Development of the project demanded yearly programs of try-out in the schools, followed by yearly revision. The financial investment was approximately $1 million a year for 5 years.

In present efforts, special emphasis is placed on the technology of education—on motion pictures, television, tapes, and most recently, programed instruction. What is of particular interest is that the development and use of these aids is increasingly under the direction of scholars and teachers, as in the production of the films for the new physics course. Until recently the use of instructional aids had been for the most part under the direction of technicians.

Also prominent in the present efforts in educational research and development is the emphasis not merely on observation, but on experimentation—not merely on collecting data, but on collecting data under conditions altered in a controlled way. This emphasis is nicely expressed in a passage in *Goals for School Mathematics,* the report of a conference on school mathematics held at Cambridge, Massachusetts, in the summer of 1963:

> . . . It has been argued by Piaget and others that certain ideas and degrees of abstraction cannot be learned until certain ages. We regard this question as open, partly because there are cognitive psychologists on both sides of it, and partly because the investigations of Piaget, taken at face value, do not justify any conclusion relevant to our task. The point is that Piaget is not a teacher but an observer—he has tried to find out what it is that children understand, at a given age, when they have been taught in conventional ways. The essence of our enterprise is to alter the data which have formed, so far, the basis of his research. If teaching furnishes experiences which few children now have, then in the future such observers as Piaget may observe quite different things. We therefore believe that no predictions, either positive or negative, are justified, and that the only way to find out when and how various things can be taught is to try various ways of teaching them.

Models and the School System

Educational reform can be sought in various ways. The technique emphasized by the Panel has two aspects. The first is the development of

models, of something tangible to show what can be done—textbooks, films, teachers' guides, as in the new physics course; also the development of new kinds of schools and new programs of teacher education. The second aspect is the voluntary selective adoption of these models through local decisions by the components, numbering in the thousands, of the American school system.

Thus, models can indicate new paths in education without interfering with traditional local responsibilites. The development of new educational programs provides the Nation's school systems with more and better things to choose from. But the school administrator or school board continues to exercise the same responsibilities.

Again, the work of the Physical Science Study Committee offers a relevant example. To be sure, the physics textbook did not simply appear on the market. Over a period of development the materials were tried out in an increasing number of schools and revised on the basis of these experiences. But, from the beginning, many schools were willing to make their teachers and classrooms available for experiment. And the program grew. School administrators became interested in what some of the Nation's best physicists were doing in this search to improve the teaching of physics. Today, of the youngsters attending high school, about one-quarter take a year of physics, and of these nearly two out of five study the PSSC course, while a considerable fraction of the remaining students of physics use some PSSC materials.

Reform as a Continuing Effort

The effort to improve education—to develop better curricular materials, better programs of teacher education, better schools and school systems—is not a one-shot affair. This activity should be carried on continuously. At the heart of the current effort lies the assumption that nobody knows the "ideal" system. Meeting immediate needs can prepare the way for longer-range reform, and new results in fundamental research will open up new possibilities. Changes in the schools will make possible changes in the colleges, and changes in the colleges will make possible changes in the schools.

If reform is to be a continuing effort, then a substantial research and development activity should be built into the educational system. Present efforts are conducted largely on a catch-as-catch-can basis. Each program requires a new effort to recruit people and to find housing. New institutional arrangements, either independent of, or in association with, universities and schools, are needed to provide permanent bases for the initiation and management of new research programs and for dissemination of the results.

A current effort to develop a built-in research component, which the Panel wishes to commend, is found in the newly enacted National Vocational Education Act of 1963. The act authorizes the use of 10 percent of all appropriated funds for research and development.

Inductive Teaching

Pedagogy is an experimental science, and to prefer one teaching method over another is to risk being dogmatic. But the experimenters must choose the places to begin research and the ways to proceed. In this sense the Panel can be said to favor a particular approach to teaching, an approach called "inductive teaching" or "the discovery method." The plan is to get students to discover things for themselves. For example, the 5-year-old who asks how many years it will take until he is 21 is beginning to discover something for himself: subtraction.

The idea of inductive teaching is not new, either. Only recently, however, has it been widely recognized that the extra burden of this approach falls not on the child but on the adults concerned with his education. Such teaching is something more than answering intelligent questions intelligently—it is creating the situations in which intelligent questions are likely to be asked. One of its objectives is to motivate learning through rewards growing out of the learning process itself.

Inductive teaching can also be described as an effort to approach a subject as creative practitioners approach it. Instead of telling students why the American colonists revolted against George III, the history teacher places before the class a collection of relevant documents from the period and asks them to find the reasons and causes for themselves. Notice, however, that somebody has to make an intelligent selection of documents and try it out on students, before inductive teaching can be seriously attempted.

This interest in learning through the experience of discovery is not meant to imply that each child must relive the entire experience of the human race. In the learning process there is a certain balance between discovery and presentation, and it may be that, as the learner advances in a given field, smaller amounts of discovery will balance greater amounts of presentation.

Education in a Changing Society

The Panel has formulated no explicit philosophy of education. Its attitudes concerning knowledge and culture are expressed through the activities it helps develop. Nevertheless, there is value in indicating, if only in brief and fragmentary fashion, the nature of some of the assumptions underlying the Panel's activities.

Interest in inductive teaching is not merely technical. It reflects the belief that knowledge is not a completed product but an enterprise that exhibits progress, and enterprise in which the student himself can be a participant. The very center of the Panel's concern, educational research and development, is not merely an effort to get more education for the dollar. It is a reflection of the belief that our society is evolving. Educational research and development is a mechanism to help the educational

system adapt rapidly to new conditions. Reform must be continuous not only because successful research opens up further possibilities but also because a changing society means changing demands on the educational system.

Some of the other assumptions underlying the Panel's activities may be briefly mentioned. The Panel sees no need to ask what field of knowledge is of most worth. Music is important as well as science, and both science and music can be sources of pleasure as well as of livelihood. The Panel recognizes that man is both a unique individual and a social animal, and that education affects the quality of both consciousness and behavior. Good education fosters disinterested curiosity and love of understanding, but it also fosters the desire to connect—to connect theory and practice, intelligence and conduct. The Panel believes that today's children must be prepared to cope with new patterns of life, that they must be equipped with good information and trained in viable modes of thinking to create new solutions.

Aims of the Panel

The general aim of the Panel is to identify research and development programs that might be of major benefit to the wide range of educational activities carried on by various Federal offices and agencies, including the Office of Education and the National Science Foundation. The Panel is not itself an operating agency. Responsibility for accepting the Panel's advice rests with the agencies.

One aim of the Panel is to attract to the service of education outstanding people outside the educational system. People engaged professionally in activities related to subjects taught in the schools—in scientific research, writing, making music, running a city—have something indispensable to contribute to education, not just as "resource persons" but as participants in the creation and evaluation of instructional tools and procedures. The schools have been off in a box by themselves too long.

The task is not only to persuade scholars and practitioners to work on education but also to devise new administrative frameworks, new institutions, by which such people can work with teachers and school principals on a continuing basis. Outstanding scholars have participated in the science and mathematics programs, including such Nobel prize winners as E. M. Purcell, Glenn T. Seaborg, H. J. Muller, and W. M. Stanley. The Panel's experience reveals a comparable willingness among workers in other fields.

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II. FIRST RESULTS

Learning About Learning

One theme arose persistently in the Panel's early discussions. Whether the problem was how to induce an underprivileged child to give school learning a try or how much a kindergarten child could be taught about fundamental mathematical operations, a question always arose about the nature of learning. How does it proceed, how can children be helped to grasp the powerful ideas of physics or mathematics or poetry? In time it became plain that, if steady progress was to be assured, we would have to learn more about learning.

The Panel helped organize a meeting of the leading experts on development, learning, and thinking in children to report on the "state of the art" and on steps to be taken to further our knowledge. With the aid of a grant from the National Science Foundation, a preliminary conference was held in Chicago in November 1962, with Jerome Bruner, a member of the Panel, as host. Here some dozen leading scholars laid plans for the preparation of working papers to serve as the basis for a 2-week work conference to be held in Cambridge during June 1963. This conference involved some 25 experts and was financed jointly by NSF and the U.S. Office of Education, under contract with Stanford University, which acted as coordinator.

Three questions soon appeared central. The first was how children can be made to engage with zest in the activity of school learning. The second was how to develop the general skills that are at the core of intellectual power. The third was how to organize information and arrange it in such sequence that it can be easily, quickly, and strongly grasped by children.

Each of the questions not only poses a problem for research but also suggests possible experimental school programs.

Stimulating the Will to Learn. It is fairly evident from existing research that the three major factors to be taken into account here are first, a recognition by the child that school learning leads to some worthwhile outcome; second, that learning is, under certain circumstances, as pleasurable an activity as an arduous sport like baseball; and third, that participation in such learning makes the child more like the adults he most admires. There is much still to be learned about these three factors—reward, pleasure, and identification through learning—but several lines of school experimentation seem advisable. With respect to the anticipated rewards of learning, more is needed in our schools to illustrate realistically the man-

ner in which schooling plays a role in life—to show what learning is *for*. The success story of young Abe Lincoln has limited relevance to the modern child, and particularly to the culturally deprived modern child from a background in which school is regarded as an interim in life. The difficulty lies to some extent in the absence of honest debate and discussion in our schools about what, in fact, schooling is for. It was strongly recommended that experimental programs be undertaken to stimulate classroom discussion of a realistic kind on the gains and losses involved in going to school. Issues such as this have for too long been taken for granted, and they should not be, particularly at this point in our technological development when the very definition of human work is changing.

As for activating learning by giving students a sense of the pleasure of intellectual work, several school experiments show already that the so-called "discovery methods" embodied in new curricula are promising. These experiments should be pursued, but far more intensive study is needed to determine how they can be improved. Some work already suggests that the chief activating element in such instruction is the "teasing value" of uncertainty—presentation of issues that are conjectural, rather than the laying out of hard, dry, finished facts. Such conjectural materials seem to act as a natural stimulant to the impulse to discover on one's own, and curriculum materials can readily be couched in such terms. For example, there is a world of difference between the flat assertion that light, under conventional conditions, travels in a straight line and the conjecture as to what would be the consequence if light travelled, for example, as smoke does.

The third issue, the role of identification in learning, is poorly understood, yet critical. Available evidence points to the importance of "competence models" in encouraging children to enter zestfully into learning—a parent or some adult who embodies or represents the values of learning. Yet, in many segments of the community such a model is not readily available and, in the case of culturally underprivileged children, a quite contrary truant model may set the psychological style. Various proposals have been made: greater use of successful and appealing adult figures in closed-circuit TV teaching, increased recruitment of men into teaching in the lower grades, more reliance upon men teachers for children who often think school is really for girls, etc.

Creating General Intellectual Skills. If it ever were possible to organize education around specific skill training, as in a highly stable village community (and this is doubtful, even in that case), it is certainly not possible to do so in a period of rapid technical and intellectual change. Specific skills become obsolete too fast. Plainly, there are some skills that transcend any particular subject matter—the disciplined use of curiosity, learning to draw suggestive inferences from minimum data, a habit of searching for relationships and analogies, honest use of evidence. A beginning has been made in assessing such general skill training. Great gains result from such

skill training, particularly when it is made an integral part of regular subject-matter courses. But even courses that have attempted to teach, say, how to use clues without regard to a particular subject have been successful in improving performance in conventional subjects. The invention and use of games that call for the utilization of information might have a similar result. The conference was convinced that great gains could come from giving closer attention to the nature of such general skills and ways of imparting them, and several studies by participants are now in progress or being planned. Several of these are being undertaken jointly with various new curriculum projects.

Optimum Presentation of Materials. The topic of presentation of materials is enormous and deep. There is virtually no trustworthy, generalizable research available to guide next steps. As a first step, several research projects on this critical aspect of the theory of instruction are now being undertaken. One particularly promising lead came out of the conference's study of various new curricula in mathematics, science, and the social studies. It has to do with the effectiveness of "contingent relationships" between a learner and a tutor, i.e., situations where the learner has some control over the pacing of the information he is getting and over the nature of the information he gets next. The ideal form of such a relation is probably the dialogue between a learner and a wise and informed tutor. But it is encouraging to see the extent to which improvement in performance can be achieved by organizing class discussion into a generalized form of dialogue, using texts and documents as resources to be tapped when needed. One experimental program in New York, for example, raised reading skills and achievement scores of culturally deprived junior high school students by more than a year and a half in less than 3 months of intensive work of this kind. Various ungraded schools have adopted the same technique with promising results. Several participants in the conference are now involved in studying carefully this contingent process, both in the laboratory and in school settings—particularly in very young children just starting school.

The conference has produced a long and detailed report that is shortly to be published as a monograph of the U.S. Office of Education. The objective of the report is to set forth guidelines for psychological and educational research in the areas mentioned above. A briefer and more general book on the same topic is also in preparation. Several research projects have emerged, on the three aspects of learning mentioned, that may serve in some measure to provide stimulus. In a more subtle way, too, the conference served to acquaint psychologists and others with problems of education and to engage their interests; hopefully, it will have the long-range effect of drawing other scholars into this important area.

Music

Other themes in the early discussions of the Panel were, first, the lack of balance in Federal assistance to the arts as compared to science, and, second, the question of whether curriculum reform as it has developed in science education could be applied to education in the arts. The Panel decided to urge an appropriate group to start a project, and it chose music as the place to begin. Late in 1962 a small group of musicians met with a few members of the Panel to consider the matter, and the response of the musicians was favorable. The project led to 2-week seminar of musicians and teachers, held at Yale University in June 1963. After the seminar, several groups of composers, artists, and educators began making plans for new approaches to musical education, including the development of new curricular materials—or rather repertory—for the music program in the public schools, from kindergarten through high school.

The Yale seminar was productive in a number of ways. A newspaper account of the seminar, which was inserted subsequently in the *Congressional Record*, stated:

> The conference . . . was a remarkable meeting of representatives of every aspect of American musical life and activity who came together with the aim of evaluating and re-evaluating American musical education in the primary and secondary grades.
>
> . . . Somehow, the congruence of a variety of vastly differing musical backgrounds, minds, points of view and approaches produced clear outlines of new concepts of music teaching designed to involve children in genuine and profound musical experiences.
>
> The impulse for the seminar came from, of all places, the President's Office of Science and Technology; the event was financed by the United States Office of Education. The prototypes for the meeting can be found in the fields of science and mathematics. The Sputnik Age found American basic scientific education still in the age of Euclid and Newton; distinguished scientists and mathematicians, working through the prestige and good offices of the Government, have since brought about an educational revolution from the primary grades on up. Now, for the first time, it was being asked whether similar reforms were not needed in one of the arts and the answer was emphatically in the affirmative.
>
> The 30 participants in the seminar included a large group of composer-educators and composer-performers (Lukas Foss, Leon Kirchner, Edward T. Cone, Otto Luening, Henry Brant, Lionel Nowak, Howard Boatwright, Gid Waldrop and, from the jazz field, Billy Taylor and Mercer Ellington), performers (Adele Addison, Noah Greenberg, Milton Katims), critics, theoreticians, musicologists and ethnomusicologists.

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There was agreement that American public school music education had its bright spots and positive achievements. The high technical quality of band, orchestra and choral performance was often cited and individual examples of excellent educational achievement were brought forward.

The general situation across the country, however, was found to be very poor; in most schools, in the elementary grades, untrained classroom teachers are charged with the responsibility of giving children the basic musical skills which the teachers themselves do not possess, and the means and equipment provided for the purpose of accomplishing this hopeless goal are almost invariably inadequate and anti-musical.

Interestingly enough, there was almost no conflict on these points between the educators and the "practicing" musicians. The educators were convinced of the magnitude of the problem and of the need for close contact between the living world of musical creation and performance, just as the practicing musicians were sensitive to the need for close involvement in the educational process from the lowest grades.

If the 12 days of panels, papers, discussions, section meetings and plenary sessions produced any ideological divisions at all, it was primarily between those who wanted to place the principal emphasis on the great Western tradition of the last two centuries and the strong group who felt that it was at least as important to broaden our musical and educational horizons to include early Western music, non-Western music, recent avant-garde developments including electronic music as well as non-concert music of all types.

A great deal of emphasis was put, not only on children's performance activities, but also on creativity; there was wide agreement as to the importance of a program designed to foster creative musical expression from the earliest grades as a means of building and training basic musicality in every child.

The importance of student involvement and activity at every level of the educational process was a constant theme of the discussions. The experience of live music was also stressed and, in this connection, it was urged that solo performers and chamber ensembles be brought into the schools on an in-residence basis similar to that already used in the Ford Foundation's composers-in-residence program.

The work of the seminar was only a first step. Its conclusions will be described in a report to the Office of Education to be made by Claude Palisca, who is associate professor of the history of music at Yale and director of the seminar. The report will serve both as a mandate and a guide for the work of a follow-up committee that will have the responsibility of finding ways of implementing these ideas in practical terms.

More was said at the seminar about music education than could be described in a brief article. A full report, based on the reports of the separate sections of the seminar, has been put together by Claude Palisca of Yale University; the Office of Education is publishing the document as one of its monographs, *Seminar on Music Education,* Cooperative Research Project No. G–013.

What follows is an elaboration of some of the points made in the newspaper story, but an account less complete than that offered in the official report. The comments are divided into an account of what is going on in music education and an account of what might go on in music education.

What Is Going On?

This project began with a comment that means and equipment provided in the school are inadequate and antimusical. A wide selection of the music books used by students and teachers was on display; the group at Yale examined the materials carefully, and agreed with the comment.

For kindergarten through the eighth grade, the materials are in the form of a graded series of books for pupils, with accompanying teachers' guides. The music series that a teacher uses determines, of course, the musical compositions that the student will come to know. The group found the materials to be, at best, versions of good music corrupted by erroneous transcriptions or by banal arrangements, such as the music and texts specially prepared for holidays (Thanksgiving: "He's big and fat and gobble, gobble, gobbles").

The music education publishing business was found comparable to the automotive industry. A small number of companies are in intensive competition, with very little variation in product. The planning of each new music series gets under way as soon as the previous series is on the market, but as from publishing house to publishing house, so from year to year the product remains essentially the same. Each house seeks to get its product used in as many places as possible, from entire school districts to entire States.

In addition to the instructional materials there is a vast amount of methodological literature. There are great controversies over such issues as the rote teaching method versus the note-reading method. And the literature ranges over all phases of music education—singing, playing instruments, bodily movement, dramatic interpretation, listening, playing skills, creative activities.

Besides looking over the various music series, the seminar group watched a number of educational films concerned with music. Some of the films were produced commercially, some by universities, and some by school systems. Except for parts of some films from a TV series on jazz, featuring Billy Taylor, which was produced a few years ago and a film made in Europe on the Carl Orff method of music instruction, the group found the films poor both musically and pedagogically. The musical selections were poorly chosen and poorly performed and the effort to arouse interest in music was based not on musical elements but on nonmusical gimmicks, such as a written note turned into a cartoon character.

There was discussion of the activities of the performing groups in the high schools. Such activities include the marching bands for between-halves at the football game, and orchestral and choral ensembles. The seminar group felt that the level of technique was excellent but, unfortunately, in marked contrast to the level of taste indicated by the music performed—including that performed by the choral and orchestral groups. As one of the participants from New York said, the whole business is like taking

the Queen Mary to Hoboken. Part of the explanation for the situation in the schools is that performance is geared to seasonal community affairs. If the music groups are to make a good showing, the selections must be popular. A second consequence is that the repertory is necessarily small, to allow time for rehearsal after rehearsal of the pieces to be played in public performances.

What accounts for this situation in American music education? According to some members of the seminar the answer lies in the separation of music education both from the sources of high art and from genuine folk art. Distinguished composers and performers have not contributed to music education in the public school system—in fact, are largely ignorant even of its existence. And American music educators have been isolated from folk art. Interestingly enough, American music educators have also been isolated from other American schoolmen. Music education is a large enterprise, however, and its history is a long one.

Widespread musical instruction has come into being through the efforts of the teachers themselves and the support of the general public. Parents and school-board members do like music. Music educators are highly organized—much more so than, say, teachers of science. The principal organization is the Music Educators National Conference, a subject department of the National Education Association boasting 42,000 members.

Music teachers in the schools were also discussed. Of course, no two schools are alike, and teachers work differently in different schools, but it is possible to divide school music teachers into four major categories. These are teachers of vocal music who specialize in the work of the elementary schools; teachers of vocal music who conduct high school choral ensembles; teachers of instrumental music who are band directors; and teachers of instrumental music who are orchestra directors. The vocal-music program of the elementary schools is taught sometimes by the regular classroom teachers and sometimes by music specialists. The time allotted to the program ranges widely, but the median is 75 minutes a week. Whatever the quality of instruction, some time is generally available.

What Might Go On?

A number of ideas for improving music education were developed at the seminar. One idea was to produce a really new, and really musical, music series for the school curriculum. The new series would engage the students' interest not through pleasant nonmusical inducements but through excitement about the music itself. The repertory would be designed to develop musical taste, not cater to it. The students would be guided to approach music, within the limits of their abilities, in the same way musicians do.

The repertory would include many different kinds of music. It would include monophonic songs, which would be sung monophonically: Excerpts from the collection of Alfonso the Wise, the Montpellier Codex, chants, folk

songs, and non-Western songs. There would also be canons drawn from all countries and styles, as diversified as possible and chosen to get away from the round into more sophisticated examples, such as pieces by von Wolkenstein, by Josquin, examples of the 19th century singing school tradition in American music, and 20th-century works. And the series would include collections of three- and four-part polyphonic music of all styles and periods.

The core of the materials would be the parts, scores, and song books of the music the youngsters would be singing and performing. There might also be a variety of supporting materials—teachers' guides, possibly records and films, possibly supplementary materials on the musical qualities and historical background of the music being performed. The scores and parts might be published in sheet-music form. More materials would be developed than one teacher could possibly use. Each teacher, according to his ability and interests and the ability and interests of his pupils, would become his own anthologist.

A project to develop a new repertory might start with choral and vocal music and instrumental music for kindergarten through grades 6, and then in a year or so also include choral music and instrumental music for grades 7 through 12. Significantly, there is no problem of primary scholarship in such a project. The repertory can be based on music now readily available to those who know where to look for it. Even for the earliest years there is abundant literature from which to choose. The contemporary period is the only period for which there is a paucity of good music for children to perform, and this lack could be easily remedied by commissioning new compositions especially for children.

The new repertory would be tested extensively in the schools, with provision for revision and further tryouts. Testing would start on a small scale as soon as the project got under way, with samples of different kinds of music tried at different grade levels. The need is to determine what children will really like, given an honest effort, and how taste develops. There is also a need to determine what gifted teachers can teach, what less gifted teachers can teach, and whether the more gifted can find ways to teach other teachers how to teach better.

A second idea was, broadly stated, to use the inductive method in teaching music. The seminar felt that music lends itself naturally to this procedure, the repertory itself constituting the basis of the "curricular materials." Thus, although in the performance of music there would be certain standards of accurate rhythm, clear tone, and so on, the repertory itself would serve as the basis for the inductive teaching of musical form, general harmonic and tonal structure, and the history and literature of music. Instead of formal learning, however, such as might be appropriate at a more advanced level, musical principles would be drawn from the music the children themselves perform. The grouping, mentioned above, of music into monophonic, canon, and polyphonic music indicates the beginning of some thinking in this direction. A child can discover for himself the characteristics of different musical forms.

The inductive method could also be used in teaching technique—such things as pitch, rhythm, timbre, dynamics, tempo, duration. The curriculum might begin with singing by rote, lead to remembering and reproducing melodies and musical elements, and go on to sight-singing and dictation. The choice of procedures, of course, would remain a matter for ingenuity and experimentation. And performance of music could be used to bring out problems in musical interpretation. What was the original intent of the composer, what changes in interpretation have taken place, what are the effects of different interpretations on the musical sound? Taste is a matter not only of repertory but of performance.

A third idea was to teach children not simply to perform and listen to other people's music but, from kindergarten on, to improvise and write music themselves. Professional musicians today tend to be either performers or composers, although some are both, and before Berlioz and Wagner everybody was both. But in the first stages of musical education there is no need to make any broad distinction. Here again there might be a natural sequence of development: for example, improvisation, inventing music not written down, composing in written notation—all coupled to rehearsing and performing the student's own work.

Little attention is now given to musical composition or improvisation because of the general feeling that, to compose or improvise effectively, the child must possess special talent, or because of the feeling that the child does not have enough information about music to be creative. Why should not children have as much originality in handling sounds as in handling paints, dolls, or baseballs, or in doing science and mathematics?

A fourth idea was to bring professional musicians into the schools on a large scale. Such a program could include a variety of activities. One notion was to establish a system of ensembles in residence. String quartets, woodwind ensembles, jazz combos that are true improvising groups, and so on, could be assigned on a yearly basis to particular schools or school systems, to perform and to teach. Artists on tour could make appearances in the schools of the cities they were visiting; this happens today, but not as a matter of routine. Musicians in a given community who play in the symphony orchestra—a part-time job except in the largest cities—could also teach in the schools. In fact, musicians could be used in a variety of capacities, from that of regular part-time teacher to that of occasional visitor who performs and listens to the students perform.

Having musicians in the schools would be good for education and good for the musicians. Such an effort would work to stop the growing alienation of the musical profession from American life and education. Of course, techniques for coping with teacher-certification requirements would have to be worked out. Musicians would immediately benefit by having an added source of income. Musicians have difficulty earning money in their profession; only violinists are in short supply. Many of the musicians now making TV commercials would welcome the opportunity to form ensembles

to be in residence in the schools. Having resident musicians in the schools makes economic as well as pedagogical sense, in a way that having resident scientists in the school does not.

The seminar also raised, without attempting final answers, some of the questions that future programs will have to face.

How do you relate what is going on in the school to the youngster's previous musical experience and to what he is hearing at the same time outside the school? Teaching must start where the child is. He has been conditioned by quantities of background music. How can this be used as a point of departure? What special problems does it pose? Since music is used as a background to so much of what we do, from watching a movie, to doing homework, to eating, it may be that youngsters are conditioned to regard music as a peripheral rather than a central focus of activity.

How do you introduce jazz into the curriculum? Jazz need not be treated in isolation but can be related to other pieces that youngsters are performing and hearing. For example, after performing or hearing a long-hair piece that consists of a theme and variations, one could then hear an Art Tatum recording. And surely, in any treatment of improvisation it would be immediately appropriate to introduce jazz. Perhaps the problem of incorporating jazz will find its easiest solution in the approach that starts children off improvising and composing music themselves. The difficulty of relating classical music to jazz may be part of the difficulty of relating what is going on in the schools musically to what is going on outside.

Once a project is under way, how do you proliferate what you are doing? How do you show other teachers how to teach the new repertory, or to teach, say, composing and improvising? How do you convince teachers, supervisors, and principals that the program will work? Films of good teachers teaching youngsters selected aspects of the new series could form an important part of the retraining or initial training of music teachers .

How is performance of music to be related to listening to music? Should youngsters hear recordings of the music they are themselves performing? Should they hear the music performed live by professionals? Should they hear different but related works—the same themes treated differently, or different themes treated in similar manner? At a certain stage, perhaps from the beginning, children absorb the ideas and concepts of music faster than they can acquire the technique to perform music. Children should see themselves as possible makers of music, but this does not mean that they cannot understand something unless they do it themselves.

How might the experiences of high school instrumentalists be broadened? One suggestion was to introduce ensemble playing to supplement, or even replace, present orchestral and choral groups. This move would not only allow the youngsters greater initiative in repertory and interpretation but would provide experience more relevant to later activity in amateur groups. Another suggestion was to improve the quality of the music played by marching bands by getting contemporary composers to write for these groups, as

an extension of certain projects already begun under the auspices of charitable foundations.

The Panel wishes to commend a new project by the Juilliard School of Music, supported by the Cooperative Research Branch of the Office of Education, which will seek to develop some of the ideas advanced at the Yale seminar. One aim of the project will be to develop a new, and genuinely musical, music series for the school curriculum, to start in elementary school, with provision for extensive tryouts in the schools. The project will involve the efforts of composers, performing artists, and musicologists, as well as the efforts of music teachers and educators.

Teacher Education

The members of the Panel, and many other people as well, agree that there is no more important prerequisite for improving the educational system than improving the preparation of teachers. Disagreement arises over how to do it. This section of the report is based not on a special seminar but on discussions held at the regular meetings of the Panel, and also on the results of a series of 1-day and 2-day meetings in which various members of the Panel met with other people involved in teacher education.

The Panel has approached the problem by way of the implications for teacher education of the new curricular materials that have recently been developed and, more broadly, the implications of other forms of educational research and development, such as work in team teaching and in nongraded schools.

One implication is that a teacher (sometimes referred to in this report as "he," sometimes as "she") must be better educated than he now is in the subjects that he teaches. But achieving that superior education depends not only on studying more mathematics (if the prospective teacher is to teach mathematics) but also on the parts of mathematics which are studied. A prospective teacher of elementary mathematics may gain more insight by studying elementary mathematics from an advanced point of view than by studying, say, differential equations or even modern algebra.

A second implication is that prospective teachers must study a number of things that a person seeking only competence in the subject need not study—pedagogy and related matters. In teaching science, for example, the teacher must not only know his subject but must appreciate how this subject appears to children who do not know it yet.

A vast number of institutions are now busy offering instruction in pedagogy and related matters. But formal instruction in these institutions makes little connection with the problems that the teacher actually faces once he is teaching in a school, largely because of the abstract approach and the level of generality at which the material is taught. Informal instruction is less easy to describe. It includes both the prospective teacher's own experience as a student in any subject—for teachers tend to teach as they were taught—and his experience in practice-teaching programs. This aspect of teacher education has all the advantages and disadvantages of an apprentice system. The teacher learns by first-hand observation, by doing, but if the present mode of instruction is not adequate to the new curricular materials

and classroom procedures, its inadequacies will be perpetuated or, at best, corrected very slowly. The Panel feels that present modes of instruction are, for the most part, not adequate to the new and more demanding tasks teachers are being asked to perform.

In improving the education of teachers, the problem is not only to develop new modes of education but also to develop rapid ways to disseminate ideas. Indeed, in view of the numbers of people involved, devising an efficient way to disseminate ideas becomes a major aspect of the problem. Efforts at improvement must affect education at three levels, each well populated: (1) the preservice education of teachers, where new programs might be fitted into the existing educational scheme; (2) the inservice education of teachers, which may require development of new kinds of programs and institutions; and (3) the education of the teachers of the teachers, a group which would include both professors of education and master teachers involved in practice-teaching programs.

There are many ways to analyze the problem of improving instruction in pedagogy, and any breakdown inevitably begs certain questions, but the Panel has found it useful to distinguish certain segments of this problem. Discussion of each segment is addressed to several aspects of the problem, and, of course, this analysis is not offered as covering all needs in teacher education.

In addition to Panel discussions, this section of the report is based on the following special meetings: Meeting of November 9, 1962, under the chairmanship of Francis Keppel, then a member of the Panel and now U.S. Commissioner of Education; meeting of January 21, 1963, at Teachers College, Columbia University, under the chairmanship of John Fischer, a member of the Panel; meeting of March 25, 1963, at Massachusetts Institute of Technology; meeting of June 27–28, 1963, at Teachers College, Columbia University, under the chairmanship of Lawrence A. Cremin, of Teachers College; and meeting of December 20–21, 1963, at Webster College, St. Louis, under the chairmanship of Sister M. Jacqueline Grennan, a member of the Panel.

The Film: What It Makes Possible

A large part of teacher education is preparation in pedagogy or teaching methods. One problem is to tie pedagogy to specific subjects, to specific levels of instruction, to real children, and to real teachers. A second problem is to find ways to reach rapidly and effectively large numbers of people in preservice programs and in new programs of inservice education. For help in solving these two problems, the Panel turned to a medium new in this field, the film.

The hope, in the use of film, lies in the fact that film can show real situations, provide real data for instruction in pedagogy. In a physics course, laboratory experiments enable students to see for themselves why

Isaac Newton believed what he did. Films can simulate a laboratory by presenting, for the prospective teacher's analysis, teachers in classrooms, dealing with archetypal teaching situations. The situations would include failures as well as successes. Students of teaching should surely be familiar with both, and, even with experienced teachers, examples of failure will not be difficult to come by.

Films of teachers teaching have been made before, but the good films are few in number, and even these are at best suggestive of what really could be done in this medium were its possibilities systematically exploited. Much remains to be done simply in the way of improving filming technique: one must hear the students responding in the classroom, not the instructor repeating what they say. Advances in the technology of showing the films are also necessary. Students should be able to look at films at their leisure. What is needed is a cartridge-loaded viewing device patterned after a television set. It should be as easy to view a film as it now is to play a phonograph record.

Films should prove useful at several levels of instruction in pedagogy. At one level the problem may be to teach teachers how to teach a specific course—maybe the whole course, maybe some key parts of it. The teacher's guides that accompany new courses are often effective, but films of teachers actually teaching the new course should prove much more effective. Such films would supplement rather than replace more conventional preparation; and, ideally, the teacher should also take the course himself.

At another level films can help prepare teachers for meeting recurrent teaching problems common to many courses—although the teacher in the film should be teaching a particular subject. Among recurrent teaching problems are these: How do you teach students who are convinced they cannot do the work? How do you teach students who are always sure they are right? How do you teach slow students? How do you teach students who are brighter than you are? There are special problems, too; for example: What do you do with the child who freezes when asked a question? How does a teacher get out of such a situation and how does he avoid getting into it in the first place?

At a third level the problem in instruction may be to inform teachers about different kinds of classrooms, and different ways of running a classroom. How does a class look when the teacher is lecturing effectively to, say, 25 children, or ineffectively to the same number of children? How does a class look when the teacher is working with a small group of pupils while other pupils are working by themselves or in small groups? What does team teaching look like? What do nongraded schools look like?

In developing sequences for films it should prove possible to use the same shot in several contexts, or to view a single sequence and discuss it on all levels. Perhaps a library of film clips could be developed and made available to teachers for a variety of uses. As the library grows, new uses might be found—for example, a study of the same child in a number of courses

and over a number of years, or of the prospective teacher as he or she gains in experience.

Of course, films are not a substitute for practice-teaching. The deliberations on teacher education were directed at both preservice and inservice programs, of which films and practice teaching would both be a part. The use of films constitutes a way of training new teachers not through a set of prescribed rules but through involving them in the problems they will face, and out of this experience letting them formulate their own guidelines. Career teachers would find the films useful in re-evaluating their previous experience.

To make such films will require a large initial investment of time and money. The techniques for making this kind of film have not been thoroughly explored. An initial investment in equipment and facilities must be made, and an opportunity provided to try to find a successful formula, and perhaps to fail repeatedly before finding it. In the long run, however, the costs will be small compared to the returns. Although produced for students, not teachers, the films used as supplementary aids in some of the new science courses (described in section IV of this report) indicate how effectively this medium can serve education.

Participation in the New Research

A second but related approach to training teachers, developed during the deliberations on teacher education, is that of finding ways to get prospective teachers and working teachers involved in the art of curriculum development.

One way in which a prospective teacher might learn about curriculum development is through teaching a new unit herself. Such work could constitute her practice-teaching experience. Arrangements with public schools to provide this experience could take a number of forms, one of which would be for the student-teacher to teach a class regularly once a week. On the other days the regular teacher would continue to offer more familiar and more conventional fare in the same subject.

The special curriculum unit would be independent and self-contained. Such independent units have already been developed in mathematics, and taught by student teachers. The unit can be a finished set of curriculum materials, or it can still be in the tryout stage. The student teachers report on their experiences with the materials, and, if the materials are still under development, their reports play a part in determining the form that the materials ultimately take. As in the apprentice system, the student teacher also gains firsthand experience in the classroom. In addition, she learns the content of a new curriculum unit and becomes more experiment-minded, developing a fuller appreciation of the idea of constant evolution of the curriculum.

Of course, the student-teacher is studying her subject as well as teaching it. This circumstance suggests that the two activities should be connected.

At the same time that the student advances in her own study of a given subject she can examine the problems of teaching that subject at the elementary and secondary level. Her own experience with new curricular materials and with the teaching of these materials can be a part of such an examination.

Participation in curriculum development might also take place at other levels—for example, at the level of the doctorate. The success of the new programs in curriculum development in particular fields has depended in good part upon the contributions made by scholars in those fields. In the science programs these contributions have included the design of new laboratory equipment that is at once inexpensive and elegant. There is every reason why work in curriculum development, if it is original and of high quality, should be accepted as meeting the research requirement for obtaining a doctorate. Such research might be undertaken under the auspices of a graduate school of education or of an academic faculty, or under some joint arrangement. Perhaps such doctorates should be granted through a new kind of graduate organization, specializing in the teaching of a particular subject. Thus, there might be science teaching centers, English teaching centers, and so on. Such research might also be a rewarding activity for faculties in small colleges, colleges which find it difficult to support the kind of research programs found in major universities today.

Experimentation along these lines involves the cooperation of various institutions: Cooperation between institutions devoted to teacher education and public schools, and, within universities, cooperation between the undergraduate college, the academic graduate faculties, and the school of education. At various times in the series of meetings on teacher education, consideration was given to the development of educational complexes in appropriate geographical areas. A complex would include a graduate school of education, several colleges and universities, institutions devoted principally to teacher training, a large number of public school systems, and institutions devoted to educational research and development.

Besides giving prospective teachers experience teaching in public schools and bringing them into contact with the problems of curriculum development, such a complex would provide an augmented flow of scholarship from the colleges and universities into the graduate school of education, where it might contribute to the formation of educational policies and practices.

Achieving a Liberal Emphasis

Teacher education also has broader, more liberal aspects. During her formal education a teacher should give thought to what education is for. Otherwise she will be merely a technician whose performance along set lines is being polished, rather than a free person with a voice in shaping educational purposes.

Survey courses in the "foundations of education," which persons preparing to be teachers in the elementary and secondary schools, are widely required to take, are supposed to provide this sophistication. As a rule these courses are ineffective and rated of little value by those who have taken them. Representing a potpourri of topics in the history, philosophy, and sociology of education, the courses make impossible demands on any instructor. But study in depth in the educational applications of various subjects is valuable. Particular courses should be offered in the history, philosophy, and sociology of education. The courses should appear in the free academic market—open to all students, not just to prospective teachers, with legislative and academic requirements abolished.

Courses in the history of education or the philosophy of education can broaden perspectives through raising radical questions of alternatives. Like cultural diffusion, or travel, history of education can challenge the teacher's local, present assumptions. Philosophy of education can show ideological alternatives, including the social, political, and moral ideals embodied in different classical philosophies—for example, those of Plato, Rousseau, Kant, Mill, Dewey—and the place assigned by the philosophers to education.

In this area, too, ways must be found to break down the barriers dividing the academic side and the education side of institutions of higher learning. Such a program might include the following: making courses in the history of education and so on available to all students; obtaining joint appointments, or appointments with joint approval, for professors who would teach the courses; giving academic recognition to scholars working in educational applications of their subjects.

An immediate step toward improving the quality of instruction in these fields would be the establishment of summer institutes offering work in the history of education, institutes offering work in the philosophy of education, and so on. The institutes would be held at leading universities and conducted by outstanding scholars in the subjects and in their educational application. The people attending the institutes would be professors now teaching foundations-of-education courses in colleges and universities who have had some graduate training in history of education or philosophy of education and who would like to prepare themselves more thoroughly.

Related to the proposed establishment of summer institutes is the possible setting up of work groups to design new curricula in these areas. Instructors in such courses need better textbooks and other materials. The summer institutes could then serve, among other things, to introduce the new materials to the professors now teaching courses in the foundations of education.

The Deprived and the Segregated

The new efforts in curriculum development have been addressed, by and large, to the more fortunate groups of the school population. The Panel decided to urge an appropriate group to organize a special project on education for what it initially called "the difficult 30 percent" and now calls "the deprived and segregated." These are youngsters suffering from one or more handicaps, handicaps predisposing them to other handicaps—youngsters on the hardship end of such scales as family income, home atmosphere, skin color, scores on IQ tests, location of the home in the community, location of the community in the Nation, and motivation. They are mostly the children of the poor, usually the children of Negroes, Puerto Ricans, mountain people who have migrated to Midwestern cities, workers in service jobs, people in depressed rural areas.

The project on the education of the deprived and segregated is not parallel to the other projects of the Panel, for it covers, but in a special context, a whole range of educational activities—science, reading, music, teacher education, and so on. The children and youth are different from those in other groups, and the kinds of environment from which they come are also different. The aims of education for this group should be as high as for any group, but to the extent that the starting points are different, the education must also be different.

A series of 1-day and 2-day planning meetings were held, including a meeting on nongraded schools (May 29–30, 1963). These led to a 2-week seminar on education for the deprived and the segregated, held in September 1963 at Endicott House in Dedham, Mass. The seminar was conducted by the Bank Street College of Education, under a joint contract with the Office of Education, the National Institute of Mental Health, and the Office of Juvenile Delinquency and Youth Development.

The seminar brought together approximately 60 people from a wide range of occupations and with a wide range of interests. The participants included teachers, principals, superintendents, professors of education, physicists, biologists, mathematicians, sociologists, social psychologists, philosophers, psychiatrists, novelists, criminologists, judges, lawyers, curricu-

lum reformers, people from foundations, and people from the Federal Government. The seminar was interdisciplinary; it was also interracial.

In formal and informal discussions, plenary sessions, and working-group sessions the participants explored causes, considered proposals for attacking various aspects of the problem, and strove for agreement on recommendations. A steering committee and several of the seminar working groups continued to meet over a 5-month period following the seminar, and a formal report will soon be available. (Inquiries may be addressed to the Office of the President, Bank Street College of Education, New York 14, N.Y.)

Presented here is the Panel's interpretation of the significance of certain aspects of the seminar, based on participation in the seminar by some members of the Panel and on reports to the Panel by other participants. This report also reflects the Panel's own deliberations on these questions and the discussions of the planning sessions for the seminar. It concentrates for the most part on elementary education and on the problems of the "inner cities"; the seminar ranged more widely.

Aspects of the Problem

By all known criteria, the majority of urban and rural slum schools are failures. In neighborhood after neighborhood across the country, more than half of each age group fails to complete high school, and 5 percent or fewer go on to some form of higher education. In many schools the average measured IQ is under 85, and it drops steadily as the children grow older. Adolescents depart from these schools ill-prepared to lead a satisfying, useful life or to participate successfully in the community.

The blame for this condition attaches to many places besides the schools; indeed, the schools are among the few institutions that seriously attempt to remedy it. The schools have struggled, by themselves and with the help of foundations, to master the conditions of the "inner city" and reverse the decline of schools in declining neighborhoods. Many small-scale experiments—small in terms of the full extent of the problem—show that the education of the deprived and the segregated can be improved. But the problem in its full extent remains. Passive and unhappy, many children sit in school and learn little. Much of what the school offers appears meaningless to them.

As compared to more fortunate children, many of these children, when they begin school, have had less experience in talking and listening, especially in talking with adults interested in having the world make sense to children, and less experience in manipulating objects, in putting things together and taking them apart. Many have not learned to form general concepts, as of things being similar or dissimilar. Yet this situation may be an artifact of the demands of the schools. Common sense suggests that the child learns that which prepares him to live in the world which is im-

mediate and real to him. He may have verbal virtuosity in the language of his own world, he may have imagination and creativity, yet have slight opportunity to use these attributes in the schools. The schools are in competition with another educational system, the streets.

Staffed by people proud of their professionalism and supervised by boards of education drawn almost exclusively from the upper-middle and upper classes, school systems are often crippled by social parochialism in dealing with deprived and segregated children. Levels of expectation are low. Schools in the slums are seen as engaged in a salvage operation (or, at best, in the panning of gravel for occasional nuggests of gold), rather than in a quest for liberation and quality. Reliance on traditional practices generally goes unquestioned; recruitment of teachers and other personnel is conceived in narrowly professional terms, hence professional educators are usually the only adults permitted inside the classroom. Money intended for improving slum education often winds up on established "lines" in the budget, where maximum expenditure accomplishes minimum results.

Unable to free their own resources for more effective use, school systems are also unable to marshal other available resources in the community. Insularity, lack of funds, and lack of freedom to develop new programs have kept the schools from tapping the resources of universities and colleges or of research centers and other nonprofit organizations, and from calling on the many individuals who could make contributions. While most leading civic-minded citizens of our big cities are quite familiar with welfare problems, slum clearance, and the like, they are less well informed about education or the connection between education and the social problems of the community.

Curriculum Development and Teacher Education

The Panel believes that assistance to the schools is not a matter simply of providing additional funds for more classrooms and for increasing the ratio of teachers to pupils; it is also a matter of experimentation. Schools must learn to make such services more efficient and more effective. The Panel believes that special research programs are necessary for deprived and for segregated children. These efforts will require certain familiar forms of research—curriculum development and teacher education—and certain new forms.

A special program in curriculum development does not mean production of watered-down material or any implication that these children are incapable of possessing the world of imagination, from literature to electronics, or that they do not possess their own world of imagination. But the children come to school with experiences different from those of other children and take what they have learned back to different homes. Their teachers must understand what these children know and value and must teach in a

way that builds on that foundation. These special materials might also prove useful in improving the education of the more fortunate members of the school population.

The children of the deprived and segregated do not get much help from a standard reading program. Special programs are needed. One approach may be to concentrate first on spoken English, on encouraging children to talk in school rather than constantly admonishing them to listen, and then to hit harder at reading when they do take it up. Even so, new readers will be needed, for the standard readers have many deficiencies—stilted English, unreal situations, poor connection between what is shown in the pictures and what is described in the text.

Even when the standard material actually teaches, what is learned can be disturbing to a child from the slums. For example, the slum child might read a story in which a child has his own bed in his own room and then return to a home where the entire family sleeps in one small room. The answer may be to let children themselves fill in the details of a story. A child in a story can sleep, but the pupils can say (and write) how and when he sleeps. To give children freedom to shape the manner of their learning is possible in other areas, too. In some schools the visitor will hear kindergarten children reciting nursery rhymes to a jazz beat.

Some subjects, such as arithmetic and science, can readily be taught in an intuitive, nonbookish way. Learning arithmetic—or, more broadly, mathematics—need not depend on the student's ability to read. Mathematics and mathematical problems can themselves be an introduction to reading. Instruction in science could work in similar fashion. Consider, for example, a curriculum unit on the subject of shadows. If the sun is the light source, in what direction are shadows cast when the child arrives at school? at lunch time? when he leaves school? If the light source is a light bulb, how does the shadow change as a function of where one holds the object in relation to the light? Think of the language used throughout such investigations—"bigger," "smaller," "to the right," "to the left," and so on.

Curriculum units can be designed that are self-contained and self-demonstrating, enabling children to discover things for themselves. To take another example, consider a unit consisting of a lump of plasticene and the problem, "How high a tower can you build without its falling over?" Whether a youngster tries to build a continuous structure (like one of Alexander Calder's "stabiles") or a structure with members (like the Eiffel Tower), he has at hand all the material he needs, the plasticene. Also, the youngster knows without being told when he has succeeded; he can see whether the tower is standing up, whether it is taller than another tower. These curriculum units might be designed in such a way that there would be a variety of tasks and rewards; tasks of building not just the tallest tower but the tallest tower of a certain kind of construction or the most beautiful tower or of inventing other tasks, such as building the longest bridge.

Comparable efforts are also necessary in social studies. Much time is already spent on this area, but irrelevance, hypocrisy, and misplaced emphasis destroy the value of many of these efforts. What the child needs is a growing knowledge of who he is, what kind of world he is living in, how his future role in this world may be shaped, and how he may help shape it. This is a matter for self-scrutiny, honesty, and careful observation. It is not a matter for didactic oversimplification.

Curriculum development is also needed in vocational education. It should take the form not only of providing better instruction in techniques but also of developing entrepreneurial skills and interests. In mathematics, the teacher wants youngsters not simply to be proficient in the multiplication tables, but also to understand mathematics and, if they have the talent, to be inventive in mathematics. Similarly, in subjects more traditionally related to commerce and industry, the teacher wants youngsters not only to fill existing slots in existing enterprises but to understand the world in which they live and, if they have the talent, to be inventive in developing new enterprises.

In teacher education the Panel's thinking centered mostly on elementary schools, although secondary schools deserve equal consideration. An improved pre-service program is needed, as is also a special inservice, or retraining, program, involving work during the summer or during the school year, or both.

A teacher of youngsters from low-income and segregated groups needs a certain amount of special information. The teacher must know how such youngsters acquire knowledge and how they express what they have learned; she must understand that this child, being less verbally sophisticated than children in other groups, is more inclined to want to do something than to express it in words. For example, suppose the teacher puts something out on the table which she proceeds to explain. A child in the class suddenly gets up. One teacher might say, "Sit down in your seat," and might interpret the behavior as a sign that the child is not paying attention to the lesson. Another would see that the child is, in fact, so involved in the problem that he wants to get to work on it right away, rather than listen to the teacher talk about it. The teacher must learn how to set up materials and situations which will help children answer their own questions and guide them to ask new questions.

One quality a teacher should possess can be characterized only as personal warmth. A teacher may express warmth in many different ways—by physical contact, by listening when children talk to her, and by the kind of understanding that is typified by a parent's fulfilling his child's request for a glass of water before he goes to sleep, even though both the child and the parent know the child is not really thirsty and that this was not the reason for the request.

How are such competencies best developed in the teacher? One approach, of course, is simply to write the needed information down in a

textbook or to present it in lectures. The Panel believes, however, that much of the necessary knowledge about conducting classes cannot be conveyed didactically. The message will not stick, and, in fact, most of these ideas have already been expressed in textbooks, manuals, and lectures; theory clearly is not enough. Films, as discussed in the section of this report devoted to teacher education, although valuable in any program of teacher education, are especially valuable in the education of teachers for the deprived and the segregated.

Films would be especially useful here because so much, in teaching this group, is nonverbal. Filmed situations could provide excellent practice in observing children as a means of finding out what they have learned and what they are ready for next. Evaluation of children's learning need not depend solely on written tests and verbal explanations or recitals but should include observation of what the children are actually doing and saying as they work or talk together. Films should prove effective in convincing teachers that these youngsters really can learn, and that they will learn more effectively through their own activity and discovery than when they are forced to sit still and listen to somebody else.

As in other programs of teacher education, the films and other materials must be related to practice-teaching sessions under the guidance of master teachers. And, as discussed in the next section, the schools themselves can play an important role as institutions for teacher education.

Institutional Innovation

New projects in curriculum development and teacher education fall far short of exhausting the possible uses of research in improving education for the deprived and the segregated. Also necessary is innovation in the institutions of education—classroom practices, recruitment and utilization of teachers, use of the school building, relationship of the school to the community. Some of the programs outlined below represent extensions of work already begun, others represent new beginnings. The order of the listing has no special significance.

Extra Hours. As facilities, the schools lie idle much of the time. Moreover, much learning is accomplished through less formal activities—reading, art, laboratory, shop—than those of the classroom, and many children have little opportunity at home for such activities. Together these factors suggest that the schools be kept open (with informal supervision) afternoons, evenings, weekends, and during the summer.

New Housing. More classroom space is needed, but this does not mean that new buildings must take the same form as familiar buildings, or that new space cannot be found in buildings already in existence but not designed originally as schools. Experimental programs can be housed anywhere and still be part of the school system—in a housing project, a separate small building, a store front, and so on.

Flexibility in Zoning. The turnover of the school population is quite high. One large cause is the local transiency of the parents, who move only short distances but far enough to take their children out of one school zone and into another. Changes in school-zoning policy can help correct this matter.

Inspired Amateurs. People who are not professional teachers but who are competent in some subject can tutor in reading, music, and other areas as a part of the regular school program. What the seminar came to call "inspired amateurs" can bring a freshness and optimism to education. This is the way to get the services of many talented and able people who, until recently, did not think of themselves as qualified to work with children. In addition to new programs instituted, the voluntary programs already under way along these lines should be encouraged.

Nongraded Schools. In most schools today, the child functions as one member of a large group. But children vary in capacity, skill, fund of knowledge, level of motivation, and specific interests. In the nongraded school each student advances at his own speed. In the basic subjects of English, mathematics, science and social studies, students are grouped on the basis of achievement. Each youngster is grouped with other students of similar accomplishments. Each, then, moves at his own rate of progress. In the graded-school arrangement the second-grade teacher is like a college professor looking over the freshman class, complaining that pupils are coming to her ill prepared, but never joining with the first-grade teacher to work on what is really a joint problem. Nongraded schools, which seem to benefit any child (there is considerable experience with this structure, but mostly with middle-class children), may be of special benefit to the children of the deprived and the segregated.

Team Teaching. In team teaching, in place of the conventional arrangement of one teacher associated with many pupils, a group of teachers is associated with a proportionately larger number of pupils. Team teaching is sometimes used in conjunction with the nongraded format. It allows for variation in class size, depending upon the kind of instruction offered, and it allows teachers to specialize in the subjects in which they are particularly proficent.

Teacher Resource Rooms. In many schools today teachers spend all their time teaching, with no opportunity to plan new activities or to compare notes with their colleagues. Schools should have teacher resource rooms and should give teachers time to use these facilities. A step in this direction has been taken in the team-teaching programs. The team leader meets at least once a week with the teachers under his direction, to evaluate the work of the previous period and to plan future activities.

The School as a Teacher-Training Organization. The schools should serve as educational institutions not only for the pupils but also for the teachers. In a pre-service program, schools could provide paid internships for student teachers, working under the supervision of master teachers,

and the use of block methods could permit the student-teacher to work 6 months and then study 6 months. In an inservice program for working teachers, instruction can be tied to the introduction in a school of a new project. One barrier to change is the insecurity teachers feel in the presence of something new, of uncertainty about what to do tomorrow.

Preschool Centers. The child may be father of the man, but the preschooler is father of the child. A system of schools for children aged 3 to 6 would offer a broadly educational nursery school program. Nursery schools, now accepted by a large segment of the middle-class population as valuable preparation for the more formal learning to take place later on, are probably even more essential for the deprived and the segregated. But they must be schools, not just day-care centers.

Work-Study Programs. At the other end of the school sequence, the basic components of any work-study program are: Part-time work for which wages are paid and part-time formal education—academic, vocational, or a combination of the two. Work becomes meaningful, because education helps youth see the personal and social implications of their jobs; education becomes meaningful because it enables youth to undertake new jobs. Work also becomes meaningful when the tasks undertaken are personally rewarding and useful to the immediate community. The work could include converting empty lots into playgrounds and parks, painting and repairing apartments, making furniture and curtains, and perhaps even building schools and other public facilities—a kind of urban CCC. The work might also include service jobs, such as teaching in elementary schools, assisting in hospitals, social work, maintenance work in parks, work in day nurseries. (By far the largest and most developed work-study program is that of the *Ecoles d' Apprentissage* in France; someone should see whether the French experience has any relevance for contemporary America.)

Music and Art Centers. Instruction in music, art, theatre, photography, and so on is not new in the schools, but such instruction might be undertaken in new ways. Special, separate facilities might be established which, while still part of the school system, would include work shops, art galleries, auditoriums, and the like. Means might be found to utilize the services of professional musicians, artists, and so on. The members of the staff of a center might work part-time for the school system and part-time for a symphony orchestra, or a university art department, or a theatre.

Book Allowance. Students might receive a yearly book allowance, perhaps of $10, in the form of stamps. The stamps could be used to buy paperbacks broadly related to the studies in which the student was, or might be, engaged. Teachers in the school system could draw up long lists of acceptable books. Provision of a similar allowance for tools, art supplies, music and musical instruments, might also be possible.

Regional Technical Schools. In rural areas the need is great for vocational and technical training to provide a base for industrial development, yet potential students are distributed widely over any given region. What

is required is not just good schools but schools with dormitories attached, so that students from all over the region can attend.

Local Option in Educational Testing. Whatever the shortcomings of tests as a means of grouping children in the more fortunate economic segments of the population (shortcomings discussed in section III of this report), they are slight as compared with the inadequacies of tests for grouping the deprived and the segregated. Serious underestimates of ability and misclassifications have occurred. One immediate remedy is to insist less upon the use of such tests. At present, tests are generally required by superintendents of schools or boards of education; they are not a matter of local option. Of course, this is not to say that tests appropriate for these children should not be devised. It would be helpful to be able to distinguish quickly between mental retardation and what people who work with slum children call "pseudo-retardation."

Model Systems

To develop fully these lines of innovation, still another form of experimentation must be added: the establishment of model school systems—or, within a big-city system, subsystems comprising about 20,000 pupils and 30 principals. Nongraded schools, team teaching, and other lines of institutional innovation are fruitful, but in terms of the total problem the steps taken so far have been modest. A new unit of research and development is needed. With a school system (or subsystem in a big city) as an unobstructed testing-ground, new programs can be developed, not in isolation, but in concert and on a proper scale, with provision for rapid feedback and rapid exploitation of new opportunities as they occur. At present, what can be done in one area of research is limited by what cannot be done in another area. The management of the system itself will also be the subject of experiment.

The school "system" is a natural unit for reform. The system is an organic, semiautonomous unit of education, with pension plans and supervisors, principals, promotion and hiring procedures, specification of jobs, adoption committees. It has electoral responsibilities, public-relations problems, budgetary experience. World War II measured armies by divisions because the division was the smallest military unit that included all services—infantry, artillery, tanks, and air. The school system is the "division" of education.

Within a big-city system, a model subsystem would report directly to the superintendent of schools. The subsystem would have its own lay advisory council or "board," including members of the school staff, members of academic faculties of universities, and artists, musicians, writers, lawyers, and other interested people from the community. The subsystem could be developed cooperatively by a university, an association of universities, or a special nonprofit organization and the school staff. Selection of the

"board" would be made with a view to its task, the cooperative direction of a comprehensive experiment.

The subsystem should be of such superlative quality that it would draw children from middle-class as well as deprived neighborhoods. Such subsystems could be started in the Nation's 10 largest cities and could be staffed partly by people already working in the schools of these cities, partly by newcomers, partly by outsiders. Support could come from sources not usually available directly to the cities—from the large foundations and the Federal Government—and could build up to around $10 million a year for each system.

Model systems are needed as testing- and demonstration-grounds for new programs. Novelty in one area may require changes in other areas. If a program is really to be tested, freedom to make those other changes is also necessary. To offer one example, new curricular materials require that children play a more active role in their own education. This has implications for the relationships between pupil and teacher, but it also has implications for the relationship between teacher and school principal. If the pupil is to exercise more initiative, the teacher must also exercise more initiative, and this means he must be given a freer hand by the principal. The lesson plans that teachers now generally prepare for their principals should not work against an approach to education that requires teachers to exercise more initiative.

The lines of innovation sketched in the previous section can be pursued separately, but when they are pursued together, many new possibilities open up. To offer a more extended example, such structures as nongraded schools and team teaching have been combined before, but they might now be combined additionally with new procedures for recruiting teachers (persons can be hired who are not yet certified); with use of the school as a teacher-training institute (in cooperation with local colleges and universities); with introduction of new curricular materials (new teachers can be trained immediately in their use); and with use of other professional people outside the schools (persons who helped develop the new curricular materials can help train teachers in their use).

The idea of an autonomous subsystem within a big city school system is not new, nor are the specific programs discussed above. What is new is the notion that such a subsystem would be an experimental system, with freedom to experiment across the board—curriculum, recruitment of teachers, utilization of teachers, the management of the system itself. The system would be sufficiently large to avoid the inherent artificiality of the experimental school. Also new is the proposed systematic involvement in the experiment of resources outside the school, such as colleges and universities. The hope is to develop effective patterns in schooling that can be adopted by other school systems at considerably less expensive.

III. WORK IN PROGRESS

Early in its discussions the Panel listed a number of areas other than science and mathematics in which new research and development seemed needed. The Panel has helped to start some new work in some of these areas, but this constitutes but a small piece of the total job. Much remains to be done, and the list itself is incomplete. Here is the list; the items are varied, but no attempt is made to sort them out:

learning about learning
music
teacher education
deprived and segregated
vocational education
reading
arts, graphic art, and skills
English composition
social studies
history
educational testing
programmed instruction
audio-visual aids
education of principals
school administration
teachers' pay and perquisites
education of women
adult and continuing education
libraries
museums
bricks and mortar

The Panel hopes to help launch additional projects. It has already discussed some of these areas, and what follows is a brief report of these essentially informal discussions. The order in which these discussions are reported is of no special significance.

Reading

Many children learn to read easily, but a sizable percentage find the task difficult. The search for better ways to teach reading is worth considerable effort because so much else in school and life depends on the ability to read. The Panel's present thinking is that the improvement of reading instruction may require both a long-range and a crash program.

The long-range program would include an effort by linguists and others to develop, in a form suitable for pedagogical purposes, a code of correspondence (including rules and exceptions) between the fundamental written units and the fundamental sound units. The work will have to be both painstaking and imaginative if it is to stand up as truly scientific against the claims currently made by the proponents of various methods of reading instruction: the look-say method, phonics, various mixtures of the two, and so on.

The crash program would have as its objective the production of materials that, however far from perfect, would be better than those now in use.

There would be attention both to the formal elements of reading instruction and to what the children read. Some new teaching materials might be helpful, such as an inexpensive device which simultaneously displays the word and makes the correct sound, and which children can manipulate themselves. Another idea is to so arrange the whole instructional program that the child is permitted to advance while still making mistakes of a certain kind, which are left to be tackled as refinements later; for instance, a child may learn to tell a story before his grammar is brought up to standard. A third idea is to make better use of the considerable amount of spoken English, patterns as well as words, which the child has mastered before he starts learning to read.

In connection with its discussions on reading, the Panel helped organize a 1-week seminar on reading, with some 20 participants, held in January 1963. The seminar was sponsored by Indiana University under contract with the Office of Education. This seminar led to regular meetings, during the summer of 1963, of a smaller but similar group in a program at the University of Washington, Seattle, supported by the Center for Applied Linguistics and the University of Washington.

Social Studies

From his entry into kindergarten or the first grade until he leaves school, the American child and adolescent attends classes in social studies; the subject is omitted in only 1, or, at most, 2 of the 13 years.

This apparent continuity, however, is an ideal rather than a reflection of any real state of affairs. Behind the rubric "social studies" there lies an enormous range of subject matter. In the early grades, the aim in social studies is usually to acquaint the child with the nature of the community in which he lives. In the later grades, "social studies" may be stretched to cover economics, psychology, anthropology, civics, and "problems of democracy"—even, in some school systems, driver education, household economics, and job guidance.

Dissatisfaction with the present state of affairs is widespread. Neither scholars nor teachers—nor people in such professions as government or business—believe that the existing potpourri of courses gives a fair representation of the several disciplines these courses are supposed to cover. Viewed more broadly, there is dissatisfaction with the lack of coherence among the various courses: what knowledge the courses may transmit is fragmentary and disjointed, and the sole thread of continuity is the common name. Finally, there are fears that when such courses treat of communism or of Russia or, domestically, of poverty or race relations or other controversial subjects, public pressure will impose upon the schools materials which are so bland or over-simplified as to be useless.

At the same time, despite some impressive beginnings, this general dissatisfaction has not yet been widely translated into action. Part of the prob-

lem is to establish means by which competent social scientists and scholars might be attracted to engage in educational efforts at the precollege level. People with extensive experience in government, at the local and at the national level, and others with experience in public affairs might also have much to contribute to such educational efforts.

In connection with its discusisons of social studies, the Panel helped organize two 2-day conferences which brought together scholars from the different disciplines in the social sciences. The first of these was held at the Center for Advanced Study in the Behavioral Sciences, in December 1962; the second, at Purdue University, in May 1963. The conferences were sponsored by Stanford University and supported by the National Science Foundation.

"Negro" Colleges

One matter which the Panel has considered which is not on the list it initially drew up is the range of problems that Negroes face in seeking to obtain an education. At a session in April 1963, the Panel came to focus on what could be done to improve colleges that could be called "Negro." Guests at this session included Albert W. Dent, of Dillard University; Lloyd Ferguson, of Howard University; L. H. Foster, of Tuskegee Institute; and Joseph C. Paige, of Howard University. It was proposed to associate Northern universities with colleges attended predominantly by Negroes to work out a program for improving these colleges. A project along these lines, with support from private foundations, will get under way the summer of 1964.

Educational Testing

The matter of educational testing cropped up in many of the Panel discussions of other subjects—in sessions on learning about learning, on education for the deprived and segregated, and so on. Together with several guests, the Panel also devoted a session to testing.

The discussion at this session ranged over what is happening today in the testing field, and the participants then considered some new directions in which research in testing might move. At present, tests are used largely to assess or identify individual differences. They are used for the following purposes (among others): for guiding pupils; for selecting the students who go to college (and determining which college they will go to); and for selecting the persons who get jobs (and determining which jobs they get). The principal virtue of the best tests is that, empirically, they have proved helpful. The principal criticism is that human abilities and achievement are more complex and subtle than any qualities the tests have yet been able to measure. This would not be so bad if the limitations of tests were fully and regularly

recognized. But there is danger that, in reflecting imperfectly what should be taught, the tests become determinants of what actually is taught. And there is danger, too, that over-reliance on tests may unduly fix the classification of a student.

These problems are not solved by saying that tests are abused, and that we should stop abusing them. The difficulty is that over-reliance on tests is easy, while the adjustment of test scores to take account of "other pertinent factors" is hard. Thus far, no one has built into the tests any protection against over-reliance or misuse.

There is very little fundamental research today on the nature of complex educational attainments on acquisition of political ideals, style in writing, mechanical comprehension, etc. There is work on personality tests and on psychometrics. The shortage is both in talent and in funds. Neither the publishers nor the universities are supplying anything like the needed volume of support. The system does produce many new tests, but it is rare today that a new publication is anything but a new edition based on an old design.

One direction in which research in testing might move is related to curriculum development. During the tryout stages of a new course it is necessary to find out which parts are too hard, which too easy or dull, which parts do not lead anywhere, and so on. This is the method, writ large, by which the good teacher improves his own courses and teaching style. Testing already does play a role in the new massive efforts of curriculum development, but it has not played the part it should. One interesting point about examinations that test the course (not the students) is that sampling procedures can be used. Not all the students need be given the same questions.

A second new direction in which testing might move is related to learning about learning and also to curriculum development, but at a deeper level. The new curricula have new goals, such as those of developing understanding, creativity, motivation to achieve, etc., but such goals are vague. Testing should help determine whether these attributes are integral or whether they are a collection of fragmented achievements, whether they can be developed through the new instructional approaches, and when and how the approach is best made. Thus, a teacher may want to present a certain part of mathematics in an early grade in such a way that the child not only learns mathematical results but also comes to understand mathematical ideas. But while it is easy enough to determine how good a student is at adding up columns of numbers, measuring his grasp of mathematical ideas is difficult. Until such tests are developed, however, the assertion that the new curricula possess the virtues attributed to them is a matter of educated guessing, not scientific demonstration.

A third direction in which testing might move is that of developing new educational materials to fit the child. We know in an impressionistic way that there are broad differences in kinds of minds, in styles of learning. (In learning calculus, some youngsters are helped by reference to physical concepts such as velocity and acceleration, others do not need such imagery

and do not want it.) It may make sense to develop alternative courses in the same subject and to develop procedures for testing children to determine which of the courses they should take. Part of this problem is the construction of a theory that would go deeper than, say, use of the terms "ear-minded" and "eye-minded" in describing kinds of minds. A crude approach to such a testing problem would be to give youngsters a week's work in each of the possible approaches to see which he finds most congenial and in which he performs best. The problem for scientific testing is to make such selection more efficient—that is, to devise a test that takes an hour instead of a number of weeks.

A fourth direction in which testing could move would be toward finding out what is really getting into the student's head—what he is learning, not whether or not he has learned what the teacher thought she was teaching. Techniques might be developed for measuring not only the answers given by the person taking the test but also the way he arrives at those answers—what he would put down on a scratch pad if he had one.

IV. PROGRESS ELSEWHERE

In the process of identifying the areas in which the activities of the Panel might be most useful, early consideration was given to the needs of education in science and mathematics.

Despte the fact that two of the three principals to which the Panel reports—Leland Haworth and Donald Hornig—are concerned primarily with these fields of learning, the Panel decided that its services were less needed in the sciences and in mathematics than in any of the other areas. This statement should be qualified in one respect: Teacher-training requirements in the sciences and mathematics are pressing, and although much is already being done, much more is necessary. This question, however, can be more appropriately considered in relation to the total teacher-training problem. In general, the National Science Foundation's broad support of science and mathematics education (first at the level of the colleges and universities, subsequently at the level of the secondary school, and more recently at the level of the elementary school) has produced the sort of activity in those fields that the Panel seeks to stimulate throughout the whole range of education.

Supplementing this basic effort, the Office of Education, under the National Defense Education Act, has been able to provide funds for the purchase of teaching materials in science.

Mathematics

Curriculum reform in mathematics was the earliest activity of the movement that has since come to be considered the new wave of educational research and development. As early as 1951 Max Beberman and others at the University of Illinois had begun to undertake a massive reform of the mathematics curriculum for the secondary school. From this program there later developed, also at the University of Illinois, under David Page, a similar program in elementary school curriculum.

Both these programs were ambitious, and both have had national impact. The major mathematics program, however, has been that of the School Mathematics Study Group (SMSG), which, with support from NSF, was set up in 1958 at Yale University under the direction of Edward Begle and which is continuing under his direction at Stanford University. During its 5 years, SMSG has enlisted the efforts on a large scale of university mathematicians, teachers, and school administrators. The materials produced by SMSG are widely used at the high school and junior high school levels and are now beginning to be used in the lower grades. SMSG has also made first efforts to adapt its materials for slower learners.

The prodigious efforts of SMSG have not deterred others from engaging in this activity. Other major programs in mathematics, most of them directed toward the lower grades, include the Madison Project at Webster College, under Robert Davis; the Minnemath Program at the University of Minnesota, under Paul Rosenbloom; the Stanford University Arithmetic Program, under Patrick Suppes; the University of Illinois Committee on School Mathematics, under Max Beberman; the Ball State Program; and the Maryland Program.

This listing does not pretend to be exhaustive. Regional and local programs exist in every part of the country, most of them devoted to the preparation of new materials for Advanced Placement courses or for the more talented students. Almost all of these smaller programs have been affected by the flow of ideas from the University of Illinois and SMSG, and there is a substantial exchange of personnel among the various programs as well.

It should be noted, also, that new programs are still being devised. The most ambitious of these, to be directed by the Mathematical Association of America, will provide films for use in colleges and in teacher retraining.

Mathematics reform, in fact, is now sufficiently advanced to have entered into a second phase. During the summer of 1963 a group of distinguished mathematicians and natural scientists gathered in Cambridge, Mass., to look beyond current activities into the needs of the future. Their report, *Goals for School Mathematics,* sets forth tentative recommendations for the next wave of curriculum reform in mathematics. Its implications for the training of teachers are far-reaching, for it can be said that elementary school teachers prepared to cope with the curriculum recommended by the Cambridge Conference are numbered today only in the hundreds, and that equivalently trained secondary school teachers are only slightly more numerous. Nor are new teachers being produced who might handle this more advanced mathematics; only a radically new approach to the teacher-training problem is likely to meet the needs created by the new curricula.

In sum, educational research and development in mathematics is currently being well served. (From the point of view of the classroom teacher one might even say that it is too well served; too often the teacher is confronted by a bewildering choice of new materials, without any criteria to help him choose from among them.) It is true that mathematics is the most tractable of all disciplines. Nonetheless, the achievement has been remarkable. Real changes have been made in mathematics education over the past 5 years, and there is good reason to believe that the process will continue.

Science

Mathematics education has traditionally been conducted as a continuum, beginning with kindergarten and continuing without interruption until the student is graduated from secondary school. Thus the SMSG could antici-

pate, in principle at least, a coherent mathematics curriculum that would extend over 13 years. However, with a transient school population there are difficulties inherent in a 13-year program as compared to individual 1-year courses such as the science courses in high school.

As a discipline, science too is coherent, but in the educational process it has never been treated coherently. Below secondary school the student may or may not encounter science in any given year, and what he meets in one year is likely to have little relationship to what he has previously met, or what he will meet further along. In the secondary school, science divides into its separate disciplines.

The first of the major science curriculum reforms was the Physical Science Study Committee, and, as its name suggests, it began in revolt against the fractionation of chemistry and physics at the high school level into separate disciplines. This revolt was short-lived; it proved impossible in 1956 to bring physicists and chemists under the same roof, and the PSSC proceeded to devote its efforts exclusively to physics. In doing so it set a model for later curriculum programs in science, and the frationation has persisted. Chemistry, biology, and physics, at the secondary school level, have each come to be dominated by a single major program; a secondary (and in fact earlier) program in chemistry has been influential but has never been widely adopted, and a new program in physics is only now developing.

PSSC was born of the enlightened conjuncture of the National Science Foundation and the Massachusetts Institute of Technology. It was the first of the massive curriculum reforms, and it continues in operation, although at a much lower level of activity. A forthcoming revision of the PSSC text will not differ in any great degree from the original text. It is reasonable to say that what was, only a few years ago, a research and development program is now in the educational mainstream. (To say this does not mean that nothing remains to be done in physics at the secondary school level.)

In biology, the American Institute of Biological Sciences entered the field soon after the formation of PSSC with the Biological Sciences Curriculum Study. BSCS set out to produce not one but three distinct textbooks, each attacking the discipline in its own fashion. Like PSSC, BSCS has now completed the major part of its task.

In chemistry, the earliest effort was made at Earlham College by a group which called itself the Chemical Bond Approach Project (CBA) and which provided a text and related materials. Somewhat later a more broadly based program, patterned after the PSSC and BSCS, was initiated at the University of California (Berkeley) and at Harvey Mudd College; it was known as the Chemical Education Materials Study (CHEMS). The work of CHEMS is now proceeding toward completion, with a textbook, laboratory equipment, and a battery of teaching films.

Thus, in a large sense, the teaching of science in the secondary schools has drawn the attention of the best scholars and teachers across the nation,

and they have accomplished the task they set themselves. But although there is much reason for satisfaction with the outcome, there are major deficiencies as well.

One of these has been indicated above. The division of science, at the secondary school level, into biology, chemistry and physics is both unreasonable and uneconomical.

Ideally, a 3-year course that covered all three disciplines would be far more suitable than a sequence of courses which pretends to treat them as distinct. Today, such a 3-year course would be difficult to fit into the educational system, but much of this difficulty might be overcome at once if such a course existed, and it might well be that present tendencies in education would soon overcome the rest.

In any case, a greater coordination of the three subjects is possible even within the existing framework. It is understandable that the groups which developed the existing programs, each of which faced great problems of its own as it worked toward its goals, were reluctant to embark on the larger task of giving coherence to the sum of their efforts. With the programs now complete or approaching completion, it may be that the time has arrived for this necessary next step.

A second deficiency lies in the fact that the programs are directed toward the college-bound student and attract the more talented students. The PSSC course, for example, despite its great dependence upon laboratory work, appeals to those who cope best with the abstract and with the great generalizations; the laboratory is used primarily to direct their attention to the abstract. Availability of a course which gave greater attention to the applications of physics might double the number of students who study physics and understand something of it when they leave school; such a course, moreover, could be prepared with the same attention to quality and intellectual rigor that characterizes the existing physics, chemistry, and biology courses.

It may well be that the time is ripe for attention to these considerations. In a sense, the very size of PSSC and its drain upon the small community of physicists may have choked off further programs. PSSC's demands on the academic community are now small, at least at the secondary school level. A new program is now being mounted at Harvard College and the Harvard Graduate School of Education; it will see physics from another viewpoint. Meanwhile, a version of the BSCS program, for students who are not college bound, is being tried out in half a dozen high schools.

In the earlier grades the start was made somewhat later, and there is considerably less to show. Moreover, the task is far greater—it appears, in fact, that in the task of curriculum reform it will always be the early grades that demand the highest degree of skill and the greatest intensity of attention.

Stimulated in large part by the National Science Foundation and the American Association for the Advancement of Science, major programs for

the early grades are now in their early stages throughout the country. The AAAS itself has a group at work under the direction of John R. Mayor. An earlier program conducted by Educational Services Incorporated (a nonprofit research corporation) and modeled closely after PSSC is progressing rapidly, as are two programs at the University of California (Berkeley), a program at the University of Illinois, a program at the University of Minnesota, and several others. The impact of these programs on the schools has yet to be widely felt, but it will not be long delayed.

Two other activities, which do not fit neatly into the foregoing categories, are also in progress at Educational Services Incorporated. One of these deals with general science for the ninth grade; some text material and laboratory experiments have already been produced, and the program is proceeding at good speed. A second program, dealing in the large with social studies for the earliest grades, will make much use of anthropological and archaeological films, and support has been received from NSF for that portion of the program; a byproduct will be material in anthropology and archaeology for use in later grades.

So far as the Panel is concerned, the greatest danger in the sciences and mathematics is that the present momentum will be spent while so much still remains to be accomplished. Two of the immediate needs were mentioned above in connection with the deficiencies of existing secondary school programs. In the near future, urgent new needs will appear, for as new curricula are introduced in the early grades, courses only lately revised for the secondary schools will be superseded. (Such a process has already taken place in the colleges, where the success of curriculum reform in the secondary schools has made it clear that fundamental changes in college courses must be made soon.) At a second remove, the greater mathematical sophistication of young students must ultimately be reflected in the use that is made of this sophistication in science courses: science without the calculus is quite different from science with the calculus, to mention what is truly only the most trivial of the considerations which must soon be taken into account.

But if the danger exists, it can at least be said that at present the momentum exists as well, that the climate today is such that mathematicians and scientists are willing to turn their hands to these programs, and that funds are being made available to them. The Panel applauds these efforts and will use whatever influence it may possess to see that they continue undiminished.

Foreign Languages

The U.S. Office of Education has assisted in revolutionizing the teaching of modern foreign languages, mainly through programs of the National Defense Education Act, initiated in 1958. With the support of Federal matching funds, 55 language-and-area centers have been designated at 34 institutions of higher education. More than 2,000 students have been awarded graduate fellowships to study 1 of more than 60 languages which

previously had been studied infrequently or not at all, and small programs of undergraduate and postdoctoral awards have been established for the same purpose. Another 652 3-year graduate fellowships have been awarded to prepare teachers of the commonly taught languages, such as French and German.

Some 224 language research projects have been undertaken under contract. Nearly 14,000 elementary and secondary school teachers of modern foreign languages—approximately one-fourth of the total number—have attended 301 NDEA summer and academic-year institutes. The availability of matching Federal funds has encouraged the installation of nearly 6,000 electronic language laboratories in public schools, compared with the 46 that existed in 1958, and Federal funds helped increase the number of State-employed foreign language supervisors from 8 in September 1958 to 60 in February 1964.

These comprehensive developmental programs have had a tremendous impact in a field of study which, until recently, was little more than a tradition-bound, neglected segment of our educational curriculum. A brief look at two NDEA programs will give some measure of what is happening.

Each of the 55 NDEA language-and-area centers deals with some world area such as South Asia, the Near and Middle East, Sub-Saharan Africa, or the Soviet Union. More than 70 different languages are taught at the centers. In 1962–63 more than 7,000 students were enrolled in some 700 language courses at NDEA centers. No less significant has been the strengthening of instruction in related-area studies necessary for a full understanding of the regions where the languages are used. The number of area-related courses in such disciplines as economics and geography has more than doubled at the centers. In anthropology and sociology the number of courses offered rose from 58 in 1959 to more than 150 2 years later. The larger centers now have at least one area specialist in each of the major disciplines.

The language research and studies program has been instrumental in opening up great new vistas in language learning. Instructional materials are in preparation in more than 120 languages heretofore rarely or never taught, and 180 different textbooks or other specialized materials in 56 of these languages have already been completed. A long-term project has been producing wholly new courses of study in French, German, Italian, Russian, and Spanish for secondary schools. Over 1½ million students have begun language study with these modern materials, and the publishing industry, stimulated by the quick and enthusiastic acceptance of these modern materials by teachers and pupils, is casting aside outmoded traditional textbooks and developing excellent competitive new courses.

With the objective of increasing sophistication in language learning, the Office of Education has initiated a host of projects in experimental and basic research. The effective use of electronic equipment is being explored; programed courses in Chinese, Russian, Thai, Spanish, and French are in

developmental or tryout stages; support for attitudinal and motivational studies has been provided; phonetic analysis has been made of special features of spoken Chinese, Arabic, and Russian; speech perception and control are being investigated; and the intricate concepts of language-learning theory are being explored.

English

Except at the graduate and professional level, more hours are devoted to instruction in English than to any other subject. More than 90,000 secondary school teachers and more than 11,000 college and university teachers are engaged primarily in teaching English, while almost all of the nearly 900,000 elementary school teachers devote a substantial portion of their time to this task. The teaching of English appears in various guises as the student progresses through the school—language arts, reading (readiness, remedial, developmental), literature (English, American, world, comparative), writing or composition (advanced, creative), grammar (English, usage, linguistics, semantics), and communication. But despite this enormous investment in instruction in English, many students when they leave school do not read well enough or write well enough to meet the practical demands of our times. Nor have many students come to value and enjoy literature.

The U.S Office of Education has set up its Project English to help improve instruction in English from kindergarten through college and graduate school. The project is recent, and the funds so far available are considerably less than the funds currently devoted to improving instruction in mathematics, the sciences, and foreign languages. Project English includes support of curriculum study centers at 11 universities, demonstration centers, projects of basic and applied research, and planning conferences.

Several of the curriculum study centers are developing sequential programs in English that build upon recent work in linguistics, literary analysis, criticism, rhetoric, and logic. Emphasis is placed on teaching students how to write clearly and effectively. One center is devoted to developing curricular materials and teaching guides addressed to the special problems posed by children from disadvantaged environments. The demonstration centers, as the name implies, are devoted to demonstrating to the educational community new educational techniques and materials. A junior high school program in English is being demonstrated at one center. Observers have an opportunity to visit classrooms as well as to attend lectures and conferences. At other centers, sets of films are being developed, on teaching reading in secondary school and on teaching literature—poetry, drama, the short story, and the novel.

V. THE PANEL

Procedures and Scope

The Panel was established in 1961 to operate under the auspices of the President's Science Advisory Committee. Like other such panels, it reports to the President's Special Assistant for Science and Technology, who is also chairman of the President's Science Advisory Committee; but the Panel is unusual in that it also reports to the U.S. Commissioner of Education and to the Director of the National Science Foundation.

The interest of the Office of Education in a program of educational research and development follows from its primary concern with education. The interest of the National Science Foundation and the President's Science Advisory Committee reflects the fact that within the past decade great improvements have been made in the teaching of science and mathematics to meet pressing needs. To an appreciable degree, scientists and mathematicians, some of them members of the President's Science Advisory Committee, have collaborated with teachers to foster these developments.

Members of the Panel have been drawn from a variety of backgrounds, including the public schools, institutions of higher learning, State and Government agencies, and other institutions associated with education.

The Panel conducts business, and works to persuade other groups to conduct business, in several ways. There are, first, the regular meetings of the Panel. Guests are frequently invited to these meetings to expand the range of competence in the room and to present special views. Growing out of such Panel discussions are a variety of 1-day and 2-day meetings to develop points of particular interest to the Panel; 5 to 15 people take part in these meetings, a few of them chosen from the Panel but most of them expert in appropriate fields. These meetings have been held on such topics as teacher education and nongraded schools. The meetings develop new ideas but serve mainly as ways to explore the feasibility of making larger studies, and in some cases to develop possible plans of approach for such studies. Finally, there are the larger studies, or seminars, lasting approximately two weeks and consisting of 30 to 50 people; again including a few people from the Panel. The seminars have been held on such topics as learning about learning, music education, and education for the deprived and segregated.

The seminars, and the other meetings too, serve as means of attracting new people to educational reform. The reports of the seminars serve both as guidelines for future action and as mandates for that action. Reports include information about what is going on in a given area, what might, ideally, go on in that area, and how to get it done. Reports also include

estimates of the size of the job and suggest possible mechanisms—physical arrangements and sources of support—for conducting research and development.

Funds for the meetings of the Panel and for some of the special 1-day and 2-day meetings come from the Office of Science and Technology, which was established in 1962 in the Executive Office of the President. The Office of Science and Technology supplies staff and other support for the President's Special Assistant for Science and Technology and the President's Science Advisory Committee. Funds for certain of these special meetings and for the seminars come from other agencies of the Government. These other agencies have included the Office of Education, the National Science Foundation, the National Institute of Mental Health, and the Office of Juvenile Delinquency and Youth Development. The seminars are supported by the usual procedures of grants or contracts to sponsoring universities, and such projects, of course, must pass an agency's usual reviewing procedures.

Action in certain substantive areas has been deferred in view of concurrent activities being undertaken elsewhere. Specifically, the appointment of special commissions to deal with vocational education and with (among other matters) education for women has made it seem advisable for the Panel to delay its own consideration of these matters. It is highly probable, however, that the Panel will deal with them at a later date, and that it will benefit from the activities of the special commissions.

In other substantive areas the Panel does not now plan to take action because work is already underway. In the sciences, for example, research and development at the secondary school level has already had considerable impact upon the educational system, and work on the elementary school level is proceeding rapidly. Mathematics is even further advanced. For the moment, at least, the Panel believes it can discharge its own obligations by keeping itself aware of such activities and by assisting in the dissemination of information on the relevant aspects of each activity to others working in the field of educational research and development.

Panel Members and Associates

The members of the Panel come from diverse backgrounds and have individual viewpoints. The publication of this report does not mean that every Panel member favors every idea expressed. The report represents the sum of the thinking of the Panel members, rather than the search for a common denominator. The Panel met formally for one 2-day meeting every month in the period September 1962 through April 1963, with meetings at less frequent intervals earlier in 1962 and in the interval from the end of the period of regular meetings through the preparation of this report.

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APPENDIX

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Participants in Various Seminars and Meetings

The ideas offered in this report are based not only on the work of the Panel, but also on the work of some of the various seminars and meetings that the Panel helped organize. These seminars and meetings covered other matters besides those reported here, and agreement was not unanimous in all matters discussed. Moveover, with the exception of Panel members who attended particular seminars and meetings, participants in these conferences have not had an opportunity to read this report. It is necessary to include lists of the participants in the seminars and meetings, yet to add the disclaimer that this does not mean that all participants endorse the ideas reported here. In offering this report, the Panel is speaking only for itself. There will be independent reports of the results of the seminars, as noted in the section "Further Reading."

THE PRESENCE OF SOMEONE'S NAME ON THESE LISTS MEANS ONLY THAT HE WAS PRESENT AT THE SEMINAR OR MEETING, *NOT* THAT HE NECESSARILY ENDORSES THE IDEAS SET FORTH IN THIS REPORT.

Seminar on Learning About Learning

A seminar held at Harvard University, sponsored by Stanford University, and funded jointly by the U.S. Office of Education and the National Science Foundation, June 14–28, 1963.

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Seminar on Music Education

A seminar held at Yale University, sponsored by Yale University, and funded by the U.S. Office of Education, June 17–28, 1963.

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Special Meetings on Teacher Education

A series of five 1- and 2-day meetings funded by the Office of Science and Technology.

November 9, 1962, Chicago

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Division of Scientific Personnel and Education
National Science Foundation
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December 20–21, 1963, Webster College, St. Louis

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Special Meeting on Non-Graded Schools

A meeting held in Boston, Mass., May 29–30, 1963, funded by the Office of Science and Technology.

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Seminar on Education for the Deprived and Segregated

A seminar held at Endicott House, Dedham, Mass., sponsored by the Bank Street College of Education, New York City, and funded jointly by the U.S. Office of Education, the Office of Juvenile Delinquency and Youth Development, and the National Institute of Mental Health, September 3–15, 1963. This list includes participants as well as observers and guests. Most of the observers and guests were present only for a day or two.

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Guests were invited to a number of Panel meetings. Here is a list of guests at Panel meetings and the particular meetings they attended:

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October 22–23, 1962

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Further Reading

Seminar Reports

Seminar on Learning About Learning (to be published by the Office of Education)

Seminar on Music Education (to be published by the Office of Education)

Seminar on Education for the Deprived and Segregated (to be available from Office of the President, Bank Street College of Education, New York 14, N.Y.)

Other Reports

Science Course Improvement Projects, Parts 1 and 2, the National Science Foundation's report of its activities in this area (Course Content Improvement Program, National Science Foundation, Washington, D.C.)

Current Curriculum Studies in Academic Subjects, a report prepared for the project in instruction (National Education Association, 1201 16th Street NW., Washington 6, D.C.)

Needed Research in the Teaching of English, proceedings of a Project English Research Conference, May 5–7, 1962 (Cooperative Research Branch, U.S. Office of Education, Washington, D.C.)

Goals for School Mathematics, the report of the Cambridge Conference on School Mathematics (Educational Services Incorporated, 108 Water Street, Watertown, Mass.)

Language Development Research and Studies (Language Research Section, U.S. Office of Education, Washington, D.C.)

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